Ontology-based Reusable Clinical Document Template Production System

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Introduction

**Increased Use of Electronic Documents**

EMR (Electronic Medical Record) systems have spurred increases in the use of electronic documents *in numbers and types*, which provides more importance in *reuse and availability of existing clinical document templates (CDTs)*.

**Professional Decision Making Processes**

CDT production is close to *clinical knowledge editing and assembling* that reflects the purpose and use intended for the document, and the main processes involved in CDT production are: *choice of relevant concepts, and their disposition inside the document*.
Clinical Document Template (CDT)

Past Medical History:
- DM: ____________
- Hypertension: __________
- Hepatitis: __________
- Drug Allergy: __________

Social History:

Family History:
Model Typology

Clinical Description Entities (CDEs) Residing in Clinical Document Templates (CDTs)

CDE Model

- Relations between CDEs in a CDT
- Relations between Domain-bound Concepts
- Relations between Clinical Concepts

Clinical Element Model
- SNOMED-CT

Clinical Contents Model
- ICD10
- LOINC
- UMLS

Domain-independent Clinical Concepts
Reference Terminologies Targeted for Specific Clinical Domains
Clinical Description Entity (CDE) Model

A Conceptual Model to Capture the Processes of CDT Production as Knowledge Assets

The model should be able to represent:
- Clinical Document Templates (CDTs);
- Clinical Description Entities (CDEs) holding a key/value pair;
- Relations: inclusion, nextness, and occurrence;
- Context in which CDEs are used; and
- Constraint that defines the range of values a CDE can hold or specifies restrictions between CDEs.

The model is formally represented as an ontology in OWL 2.

Available online at: http://vocab.bike.re.kr/cdt
Clinical Description Entity (CDE) Model

Clinical Document Template

- Context
  - hasConstraint
  - hasContext

Clinical Description Entity

- Relation
- Constraint

UsedAt

UsedAt
A Knowledge Management System Implemented to Store and Manage the Ontology-based Knowledge Assets, Gleaned from CDTs, via Web Services Interface
Knowledge Base

The Initial Knowledge Base of Instanced Populated with Instances Gleaned from 35 Hand-picked CDTs, Most Frequently Used in 14 Departments in a Medium-sized Hospital (500+ beds)

<table>
<thead>
<tr>
<th>Category</th>
<th>Occurrences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of CDE Instances</td>
<td>967</td>
</tr>
<tr>
<td>Number of <code>ContainedIn</code> Relations</td>
<td>1412</td>
</tr>
<tr>
<td>Number of <code>AdjacentTo</code> Relations</td>
<td>3142</td>
</tr>
<tr>
<td>Number of <code>UsedAt</code> Relations</td>
<td>7283</td>
</tr>
<tr>
<td>Number of CDE Instances with <code>ContainedIn</code> Relations</td>
<td>162</td>
</tr>
<tr>
<td>Number of CDE Instances with <code>AdjacentTo</code> Relations</td>
<td>932</td>
</tr>
<tr>
<td>Number of CDE Instances with <code>UsedAt</code> Relations</td>
<td>150</td>
</tr>
<tr>
<td>Average Number of CDE Instances in a CDT</td>
<td>78.0</td>
</tr>
<tr>
<td>Average Number of <code>ContainedIn</code> Relations in a CDE</td>
<td>8.7</td>
</tr>
<tr>
<td>Average Number of <code>AdjacentTo</code> Relations in a CDE</td>
<td>6.7</td>
</tr>
</tbody>
</table>
Clinical Document Template (CDT) Editor
Progress and Future Work

**Progress So Far:**
- Developed A Formal Representation of *CDE Model in OWL 2*
- Developed Preliminary Versions of *STEP and CDT Editor*
- Working to *Integrate STEP with LexCare Suite*, a Comprehensive Terminology Server

**Future Work:**
- To Evaluate STEP’s Validity and Usability
- To Make the Web Services Interface of STEP Complied to Common Terminology Services 2 (CTS2)
- To Extend CDE Model to Enhance the Description of CDTs and Facilitate Provenance Management
Any Questions?
CDT (formerly named CDE) Ontology
## STEP Web Services

<table>
<thead>
<tr>
<th>Operation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>getTDEListByContextID</td>
<td>Retrieves basic information on TDEs based on a user-specified context ID</td>
</tr>
<tr>
<td>getContextList</td>
<td>Retrieves all contexts</td>
</tr>
<tr>
<td>getTemplateList</td>
<td>Retrieves all templates</td>
</tr>
<tr>
<td>getTDEListByTemplateID</td>
<td>Retrieves basic information on TDEs in a user-specified</td>
</tr>
<tr>
<td>getTDEInfo</td>
<td>Retrieves detailed information on a user-specified TDE</td>
</tr>
<tr>
<td>findTDE</td>
<td>Retrieves TDEs similar to the name in the user query</td>
</tr>
<tr>
<td>findRelatedTDE</td>
<td>Retrieves basic information on TDEs related to the TDE ID supplied by the user</td>
</tr>
<tr>
<td>findTemplate</td>
<td>Retrieves a list of templates that contain the TDE(s) the user specifies</td>
</tr>
<tr>
<td>findRelatedTemplate</td>
<td>Retrieves a list of templates that are similar to the user-specified template</td>
</tr>
<tr>
<td>saveTDE</td>
<td>Stores a new TDE into the knowledge base</td>
</tr>
<tr>
<td>saveRelation</td>
<td>Stores a new relation into the knowledge base</td>
</tr>
<tr>
<td>saveTemplate</td>
<td>Stores a new template into the knowledge base</td>
</tr>
<tr>
<td>saveValueSet</td>
<td>Stores a new value set into the knowledge base</td>
</tr>
</tbody>
</table>